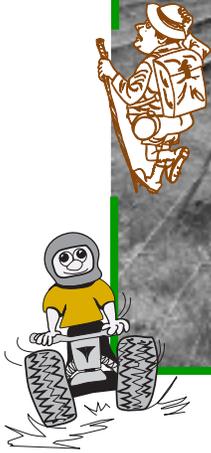
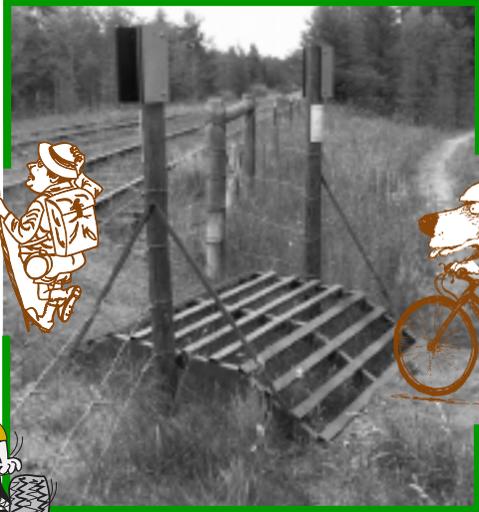


Cattle Guards for Off-Highway Vehicle Trails



Contents

Introduction	2
Selection and Installation Considerations	3
Deschutes Trail Cattle Guard	5
Caribou Trail Cattle Guard	5
Deerlodge Trail Cattle Guard	6
Challis Trail Cattle Guard	7
Sources	8
About the Author	9
Appendix A—Deschutes Trail Cattle Guard Plans	11
Appendix B—Caribou Trail Cattle Guard Plans	12
Appendix C—Deerlodge Trail Cattle Guard Plans	14
Appendix D—Challis Trail Cattle Guard Plans	15



United States Department of Agriculture
Forest Service

**Technology & Development Program
Missoula, Montana**

Brian Vachowski, Project Leader

2300 Recreation
7E72A50—Trail Cattle Guard
9823-2826-MTDC
July 1998

Acknowledgments

I wish to thank the following people for their contributions to this report.

Melissa Abbott	Challis National Forest
Mark Booth	Caribou National Forest
Dick Dufourd	Deschutes National Forest
Mike Foster	Challis National Forest
John Newcom	Caribou National Forest
Keith Simila	Washington Office
Carl Stoddard	Caribou National Forest
Eric Tolf	Beaverhead-Deerlodge National Forest
Kent Traveller	Dixie National Forest
Earl Williams	High Country Trail Riders Association

MTDC Staff: Bob Beckley, Michelle Beneitone, Dick Karsky, Bert Lindler, Sara Lustgraaf, Debbie Mucci, and Andy Trent.

The United States Department of Agriculture (USDA), prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, and so forth) should phone USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination, write: USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue SW, Washington, DC 20250-9410, or call (202) 720-5964 (voice or TDD). USDA is an equal opportunity provider and employer.

Introduction



One of the greatest sources of contention between recreationists and livestock permittees as trail use increases is gates. Gates are left open, allowing livestock to roam in places where they shouldn't. While the cows don't mind, ranchers, recreationists, and agency managers certainly do.

With dirt bike, all-terrain vehicle (ATV), and mountain bike traffic on the rise, trail managers have identified the need to evaluate small cattle guards that offer an alternative to gates.

Kent Traveller, from the Dixie National Forest, asked the Missoula Technology

and Development Center (MTDC) to evaluate and document designs for trail cattle guards that work. The cattle guards would be suitable for trails used by ATV's, motorcycles, mountain bikes, and hikers. They would need to be lightweight and easy to install, particularly when compared with the massive cattle guards used on roads.

MTDC found four trail cattle guard designs that were doing the job on several National Forests. Three are steel, or a combination of steel and wood. Another is made entirely of wood. We decided to show you all four. Differences in design, fabrication,

and installation could make any one of the four the top choice for your installation.

These designs were developed on the Deschutes, Caribou, Deerlodge, and Challis National Forests. We heard about others, but were unable to obtain documentation in time to include them. We modified the designs slightly in some instances to make them stronger or easier to fabricate and so they would be wide enough to accommodate the larger ATV's now being sold.

Selection and Installation Considerations

Think about links between safety and trail-user psychology when choosing a design. Traveling fast is part of the thrill for many off-highway vehicle (OHV) users. But in the back of their minds most users also want to travel safely. Most users will slow down if they perceive danger or a hazard.

This is where your selection of cattle guards and their placement can affect the behavior of trail users. The Forest Service does not want to encourage reckless behavior.

Keeping the cattle guard narrow is probably the best way to convince users not to speed. If they think it will be a challenge to get across the cattle guard without mashing their fingers or scraping their machines, they will usually slow down. For ATV users especially, a cattle guard only slightly wider than their machine means they will voluntarily slow down to avoid hitting the sides. A narrow cattle guard blocks vehicles wider than those allowed on the trail.

So how wide is wide enough? This is a tricky question, because ATV's seem to be getting wider each year. In some cases the width of a large ATV differs little from a small four-wheel-drive vehicle (Figure 1). The width of the cattle guards described in this report range from 4 feet (1.2 m) to 5 feet (1.5 m). Cattle guard widths of 52 to 60 inches (1.3 to 1.5 m) will allow most new ATV's to cross—just barely. Build them wider and you risk indiscriminate use by four-wheel-drive vehicles, which may not be allowed in your management plans. They are also too heavy to be supported by the cattle guards. Four-wheel drives will damage cattle guards, and their owners may claim damages if their vehicles are harmed (Figure 2).

Angling the wings of the cattle guard from top to bottom allows the top to be wider. This is often desirable to give riders, especially on motorbikes, a little extra margin for error to avoid catching



Figure 1—ATV's are becoming larger and more powerful. This Polaris Sportsman 500 is able to pull this trail/road grader on the Francis Marion National Forest, South Carolina.

their handlebars on the fenceposts.

Where your cattle guard will have little psychological effect on speed (in wide-open country, for instance), consider using the flat Deschutes Cattle Guard

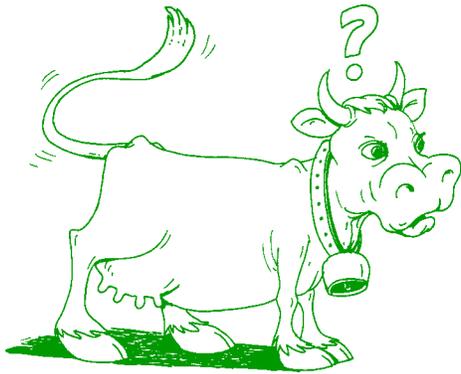
instead of elevated designs to avoid sudden loss of control caused by a change in elevation.

Psychology comes next. Will you be able to fool the cows into thinking your



Figure 2—For safety, you will absolutely want a straight approach on either side of the cattle guard. Modify the fence or the trail, if necessary, to ensure the approach is straight. Curves in the trail leading to the approach can help reduce speed. Note the gate to the right of the cattle guard for horse riders and livestock.

trail cattle guard is an impenetrable barrier to the greener grass and freedom on the other side? Probably.



The four cattle guards featured here actually work. Even when bunched up, cattle avoided these cattle guards. A trail cattle guard that meets these specifications should work:

- Length from 5.6 feet (1.7 m) for the Deerlodge Trail Cattle Guard to 13 feet (4 m) for the Caribou Trail Cattle Guard
- Suitable wings or side barriers (Figure 3)
- Spacing of about 4 inches (100 mm) between the tread rails.

If the cattle guard is too short, lacks side guards or wings, or has incorrect spacing between the tread rails, cattle may be tempted to try to jump it or walk through it. We heard of one instance of a cow that had to be destroyed after it got its leg caught in another type of trail cattle guard.

In many cases, a wire fence gate is needed near the trail cattle guard for horse riders and to allow cattle to be moved between pastures.

A few practical considerations in the design are:

Steel or wood—Steel offers long life and strength. Wood is easy to work with and might be preferred for esthetic reasons. Our examples include the



Figure 3—The side supports (or wings), extending from the Deerlodge Trail Cattle Guard to the fencepost, are essential in persuading cattle not to jump the cattle guard. Butting the posts up to the cattle guard helps keep vehicle speed down, but at the risk of catching handlebars.

all-wood Challis design, the all-steel Caribou design, and two steel designs (Deerlodge and Deschutes) that have steel, but have wood sills or bases.

Transportation—The Deschutes and Challis designs can be assembled onsite or in the shop. The Caribou and Deerlodge Cattle Guards are fabricated in the shop. All designs can be hauled to the trail site in pickup trucks or on trailers pulled by ATV's, but there are substantial size and weight differences.

Installation—Cattle Guards that lie flat on the ground (Deschutes) require excavation and periodic cleaning. Elevated designs like the Deerlodge and Caribou can be placed without excavation (except for support sills for the Deerlodge design). The all-wood

Challis Trail Cattle Guard also needs periodic cleaning. Volunteers or force-account crews can install any of these cattle guards without heavy equipment.

Cost—Cost is an important factor. We have not verified costs down to the dollar, because they vary considerably due to labor for installation, materials (new or used), and the fabrication rates charged by local shops. None of the four designs is especially complicated to construct or install. Materials for the Deschutes Trail Cattle guard cost about \$550. The Deerlodge Cattle Guard cost \$235 the last time a shop fabricated some (sill timbers would also be needed). Materials for the Caribou design run about \$150 with new materials—less if it is made with used steel fenceposts. We do not have

cost information for the Challis design, but using treated lumber is worth the expense.

Deschutes Trail Cattle Guard

After putting a lot of thought into a design, Dick Dufourd began installing these cattle guards on the East Fort Rock OHV trail system, Deschutes National Forest, in 1986. Since then, many more have been installed at BLM and Forest Service sites in central Oregon and throughout the Pacific Northwest. Both the Forest Service and BLM believe that the cattle guards have performed beyond expectations, at reasonable cost, and with minimal maintenance.

The Deschutes Trail Cattle Guard looks and works like a traditional road cattle guard. It provides a flat running surface (Figure 4). The design is a combination of a treated timber base and a steel deck made with an angle-iron frame and tread rails of square tubing. It is 5 feet (1.5 m) wide and 8 feet (2.4 m) long. The base is a wooden box constructed of 2- by 12-inch (50- by 205-mm) treated lumber. Lag screws attach the deck to the base. The wings are made of treated 2 by 4's.

Complete plans for the Deschutes Trail Cattle Guard are in Appendix A. All the materials for two cattle guards weigh about 600 pounds (270 kg) and can easily fit into the bed of a pickup truck. Although the cattle guard is designed to be assembled onsite, if the deck can be transported to the site in one piece, all of the tread rails could be welded to the angle iron frame except for the last three on each end, which would be bolted. Welding reduces fabrication time, and the bolted tread rails provide cleanouts.



Figure 4—The Deschutes Trail Cattle Guard looks and performs like a downsized version of a traditional road cattle guard.

Maintenance is infrequent and easy. You simply unbolt some of the rails and scoop out dirt that has accumulated beneath the cattle guard. The approaches tend to get beat out with heavy use, especially in soft soils. These need to be raked smooth. In some situations, it may be desirable to harden the approaches with a soil stabilizer, geoweb, or some other trail-hardening technique to keep the soil in place.

Caribou Trail Cattle Guard

The Caribou Trail Cattle Guard was designed by Carl Stoddard, Mark Booth, and John Newcom from the Montpelier Ranger District, Caribou National Forest, Idaho. This all-steel cattle guard features economical recycled steel fenceposts and is fabricated in the District shop (Figure 5). It

has been used since 1995. Cattle were bunched and held against this trail cattle guard, and were also crowded through gates right next to them, but there wasn't a single attempt to breach the ramp.

Installed, the cattle guards are 13 feet (4 m) long. They are constructed in two pieces and bolted together onsite. They can be carried in a pickup truck or on an ATV trailer.

Perhaps the major cost advantage for this design is the fact that installation takes less than 1 hour and can be accomplished easily by two people. There is no need to dig a pit or set brace posts. You simply cut any wire in the fence that is higher than 22 inches (560 mm) above the ground, set the two halves of the cattle guard in place on either side of the fence, bolt them together, and tie the fence back into the wings of the cattle guard. The ground need only be relatively flat and not too boggy.



Figure 5—Carl Stoddard poses with the Caribou Trail Cattle Guard he fabricated in Montpelier, Idaho. Recycled steel fenceposts work fine as tread rails. MTDC modified the design shown here slightly to strengthen and widen the decking. The plans in Appendix B show the changes.

Deerlodge Trail Cattle Guard

Eric Tolf, from the Jefferson Ranger District, Beaverhead-Deerlodge National Forest, Montana, and the late Darrow Hippert, McGrew Machine and Fabricating in Whitehall, Montana, designed the Deerlodge Trail Cattle Guard (Figure 7). It is an elevated design and is shorter than the Caribou or Deschutes Trail Cattle Guards.

The original design called for 2- by 1-inch (50- by 25-mm) steel channel for the tread rails. The plans included in Appendix C show an optional design using 2- by 2-inch (50- by 50-mm) steel angle instead, which should cost less.

Steel angle iron, 2 by 2 inches (50 by 50 mm), could be substituted for the steel fenceposts used here as tread rails. They would be welded at both ends to the box-tubing “stringers” with the point of the angle facing up.

This cattle guard is built with galvanized chain link fence material underneath the tread rails and over the X-shaped flat-iron support bars (Figure 6). The chain-link fence helps prevent users from slipping a foot or wheel between the tread rails. Cattle still avoided the cattle guard even with the chain-link fencing in place.

The original design was 44 inches (1.1 m) wide, but in the plans in Appendix B we widened it to 52 inches (1.3 m) to accommodate wider ATV's. The District has constructed them 36 inches (.9 m) wide for trails where ATV's are not permitted.

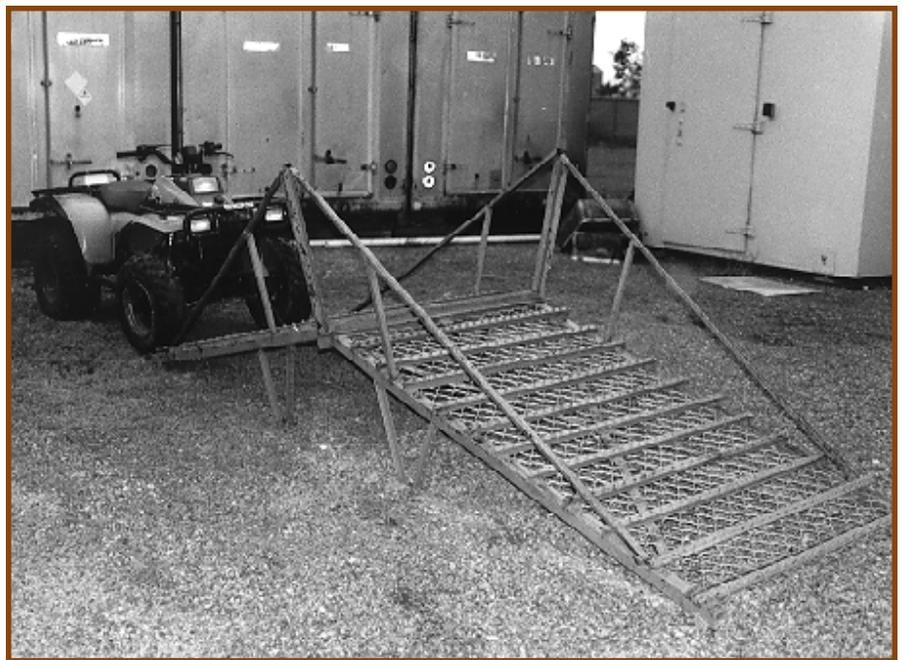


Figure 6—The two halves of the Caribou Trail Cattle Guard bolt together easily. Chain-link fencing keeps people from slipping through, but still discourages cattle.

The cattle guard needs to be bolted to at least 2- by 6-inch (50- by 300-mm) treated timbers at both ends (the plans show welded tabs for bolting). These timbers are buried. Larger timbers could be used to raise the entire cattle guard, with the approaches built up to provide a smooth transition.

For a more substantial side barrier, you might consider constructing two short H-brace fences running in the same direction as the cattle guard.

Challis Trail Cattle Guard

Howard Rosenkrance documented this design some years ago on the Lost River Ranger District of the Challis National Forest, Idaho (Figure 8). According to District staff, this all-wood design is still being used and serves its intended purpose.

Plans are included in Appendix D. If the cattle guard is set on railroad ties at two ends only, minimal excavation would be needed to level the ties. Approaches could be built up for a transition to the cattle guard. The lumber can be precut and assembled onsite. Buying treated lumber and applying additional treatment to any cut surfaces is a good investment, because it will help keep the structure from rotting.

The specified tread rail width is 48 inches (1.2 m). However, they can be widened to handle the larger ATV's—or made narrower, for that matter. The wings made out of 2 by 4's are tied into the existing fence.



Figure 7—The Deerlodge Trail Cattle Guard has tread rails of either channel or angle steel. It is welded as one piece and can be easily hauled in one piece to the installation site.



Figure 8—The Challis Trail Cattle Guard. Treated 2 by 6's are used for tread rails. (One piece of decking is missing on the right side.)

Sources

All of these designs can be fabricated by District crews or at local fabricating shops. You may also want to consider the sources below for a couple of the designs. This listing does not constitute an official endorsement by the Forest Service.

Deerlodge Trail Cattle Guard—McGrew Machine and Fabricating, Inc.
5 South Division Street
Whitehall, MT 59759
Phone: (406) 287-3916

Caribou Trail Cattle Guard—The Montpelier Ranger District may be willing to fabricate these at cost for other Forest Service units. For more information, contact John Newcom or Mark Booth at:

USDA Forest Service
Montpelier Ranger District
322 North 4th Street
Montpelier, ID 83254
Phone: (208) 847-0375



About the Author

Brian Vachowski has been a Project Leader specializing in recreation, trails, and wilderness projects at the Missoula Technology and Development Center since 1993. He received a bachelor's of science degree in forestry from the University of Massa-

chusetts in 1974 and a master's of science degree in outdoor recreation from Utah State University in 1976. He has worked for the Nez Perce, Bighorn, Winema, and Routt National Forests in

recreation, wilderness, planning, lands, rural community assistance, special uses, fire, and timber positions. Before coming to MTDC he was an assistant staff officer for wilderness and recreation on the Nez Perce National Forest.



Library Card

Vachowski, Brian. 1998. Cattle guards for off-highway vehicle trails. Tech. Rep. 9823-2826-MTDC. Missoula, MT: U.S. Department of Agriculture, Forest Service, Missoula Technology and Development Center. 16 electronic p.

Describes four cattle guards that can be used to replace gates for off-highway vehicle (OHV) trails. Drawings and photos of the cattle guards are included. Cattle guards prevent the perennial problem of gates being left open.

Keywords: fencing, forest recreation, gates, mechanized recreation, OHV, range management, stiles

Additional single copies of this document may be ordered from:

USDA Forest Service, MTDC
Building 1, Fort Missoula
Missoula, MT 59804-7294
Phone: (406) 329-3900
Fax: (406) 329-3719
IBM: pubs/wo,mtdc
E-mail: pubs/wo_mtdc@fs.fed.us

This electronic document is available on the Forest Service's FSWeb intranet at:

<http://fsweb.mtdc.wo.fs.fed.us>

For further technical information, contact Brian Vachowski at the address above.

Phone: (406) 329-3935
Fax: (406) 329-3719
IBM: bvachowski/wo,mtdc
E-mail: bvachowski/wo_mtdc@fs.fed.us

Appendix A—Deschutes Trail Cattle Guard Plans

Materials List

Material	Quantities	
	Order	Pre-cut the piece(s) to:
Base— Treated standard & better, 2 by 12 inches	2 each: 8 feet 1 each: 10 feet	2 each: 89 inches 2 each: 5 feet
Brace— Treated standard & better, 2 by 10 inches	1 each: 8 feet	4 each: 1 foot
Wings— Treated standard & better, 2 by 4 inches • With joist hangers: - OR - • With wing supports:	3 each: 10 feet 2 each: 14 feet 2 each: 10 feet 1 each: 12 feet 2 each: 14 feet	2 each: 5 feet; 2 each: 3½ feet; 2 each: 6½ feet 4 each: 7 feet 2 each: 3½ feet; 2 each: 6½ feet 2 each: 5 feet; 4 each: 6 inches 4 each: 7 feet
Deck— Angle iron, 2 by 3 by ¾ inches Steel square tubing, 2 by 2 by ¾ inches	2 each: 8 feet 69 feet-6¾ inches	Precut and predrilled Precut and predrilled, 14 each: 59⅝ inches
Hardware— Tempered steel hex head bolts (grade 5, coarse thread), ½ by 3 inches, plus washers, lock washers, and nuts		29 each
Lag screws, ⅜- by 4-inch		7 each
Barbed or No. 9 wire		±12 feet
Galvanized common nails, 16d		2½ pounds
Galvanized fence staples, 1½-inch		½ pound
Galvanized common nails for joist hangers, 6d		½ pound
Wood preservative meeting AWPB M4		1 gallon
Furnished— Posts and H-braces		
Optional— Simpson SUR 26 skewed 45° joist hanger (or similar)		4 each
Simpson SUL 26 skewed 45° joist hanger (or similar)		4 each
Paint		
Reflectors and/or delineators		

Note: All lumber shall be pressure treated with creosote meeting AWPB LP 55, or water-borne preservatives meeting AWPB LP 22. Retention shall be 0.40 minimum.

Deschutes Trail Cattle Guard Construction Notes

1—Locate crossings so the trail will cross at 90° for safety. Where possible, locate cattle guard in timbered or rocky areas to discourage access by full-sized vehicles. Pre-installing posts and braces will save time. Need 9 feet inside posts.

2—Be sure to specify the retention when ordering the lumber. Note that the lumber order is different if metal joist hangers are used (recommended). It saves time to pre-cut the lumber as shown on the materials list. This should be done in a shop to insure proper dimensions and straight cuts.

3—These are designed to be lightweight, portable, and easily constructed with simple hand tools. All the materials for two cattle guards will easily fit into the back of a standard pickup truck with the longest pieces being 10 feet. Cost is around \$550 each for materials. I use volunteers for construction. A six person crew can easily construct two cattle guards in a day.

4—In cases where the deck can be transported to the site in one piece, an alternate design is to weld all of the rails to the angle iron except for the last 3 on each end, which are bolted. This will reduce fabrication cost and still provide cleanouts on each end.

5—Paint all lumber cuts with preservative. Be sure all lumber is standard or better or it could be too warped and knotty. When putting the base together, arrange the lumber so the angle iron will rest on the flattest and straightest surfaces.

6—The cattle guard can be on a grade lengthwise, but must be level side to side.

7—Tools needed:
• Small (12-inch) chain saw
• Hand saw

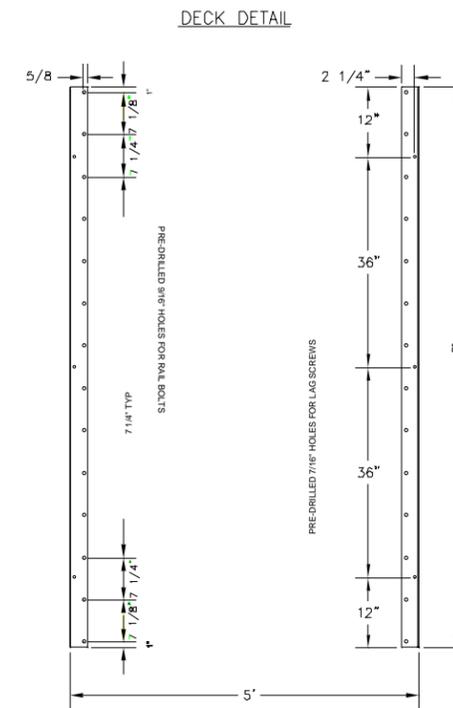
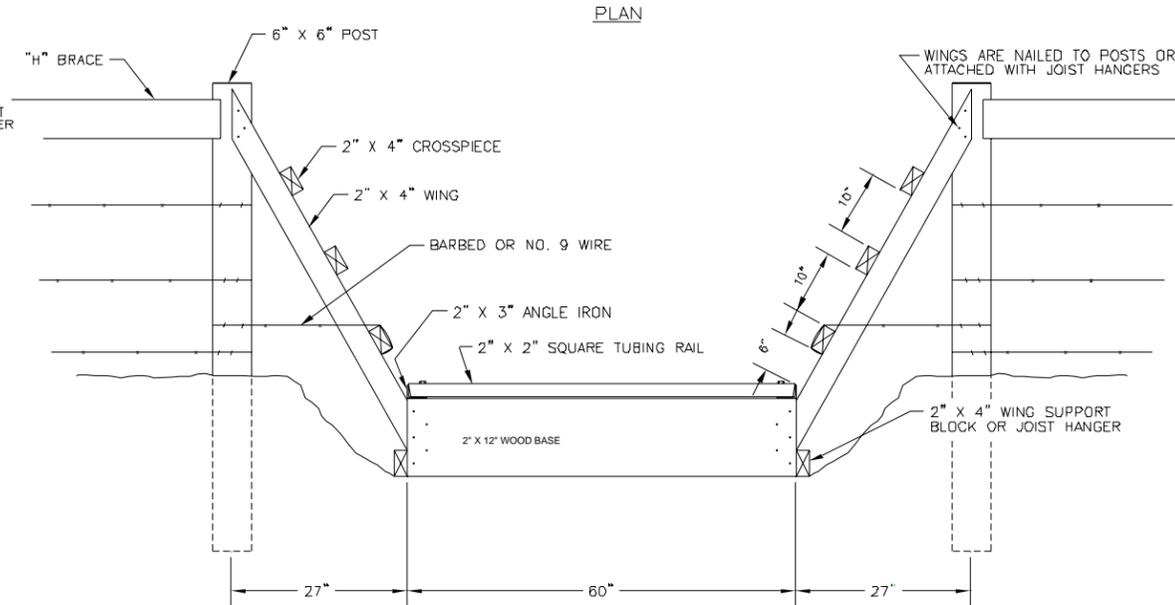
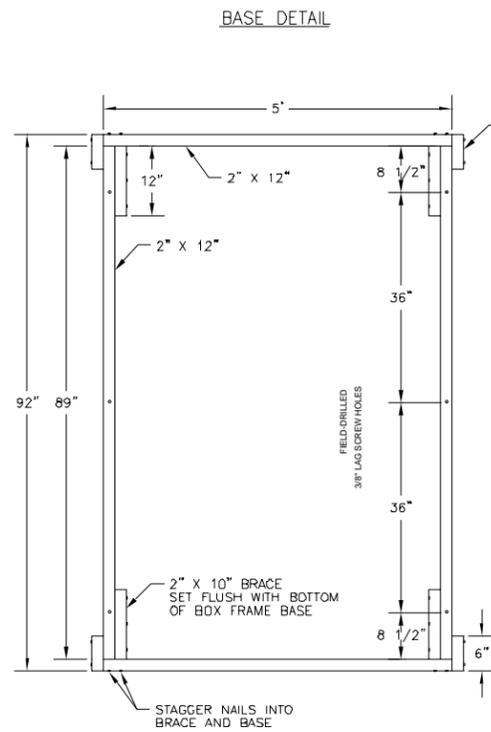
- Four hammers
- Half-inch drive socket set (2, if possible)
- Crescent wrench, 10- or 12-inch
- Brace and bit (to drill 2 sizes to accommodate lag bolts)
- Nail punch
- Two measuring tapes (minimum)
- Straight edge
- Level
- Shovels, picks, pulaskis
- Wood chisel
- Small crowbar
- Pencils
- Wire cutters or fence tool
- Two-inch paint brush (to apply preservative to cut ends)
- Gloves for all (treated timber is messy, rails are oily)
- Rod and hand level (to establish grade of excavation)
- First aid kit
- Cattle guard plan
- Chain saw chaps
- Safety goggles.

- 8—**Sequence of construction.
- Set stakes to establish four corners and grade.
 - Have part of crew excavate to grade while the others nail the box base together.
 - Put base in hole. Dirt under base must be compacted, and base must have firm, even bearing all around. Attach joist hangers (if used) before putting base in hole.
 - Square up and level base.
 - Lay angle iron on base.
 - Put one tread rail on each end and loosely attach with bolts.
 - Put on all other rails and put bolts through holes.
 - Align deck with base, then tighten bolts.
 - Recheck deck and base alignment.
 - Install lag bolts.
 - Construct wings.
 - Backfill ends. Smooth approaches.
 - Install barbed wire from bottom crosspiece to posts.

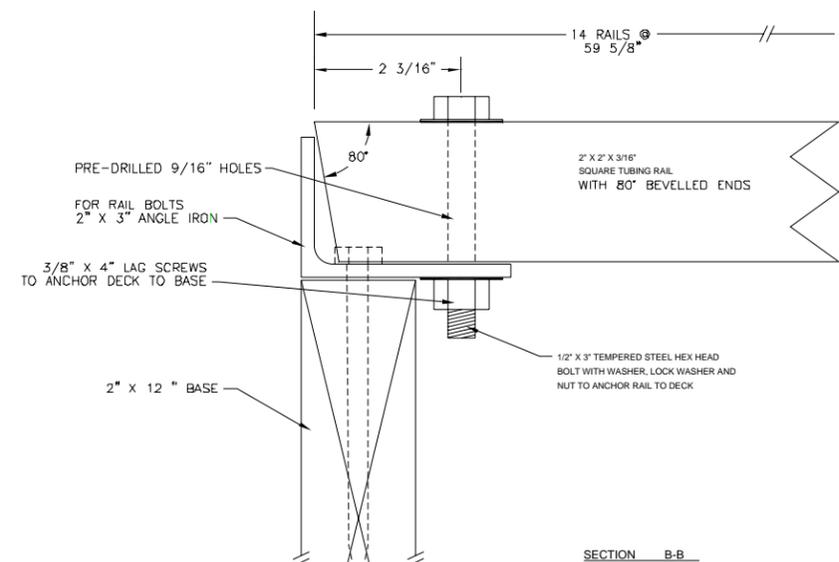
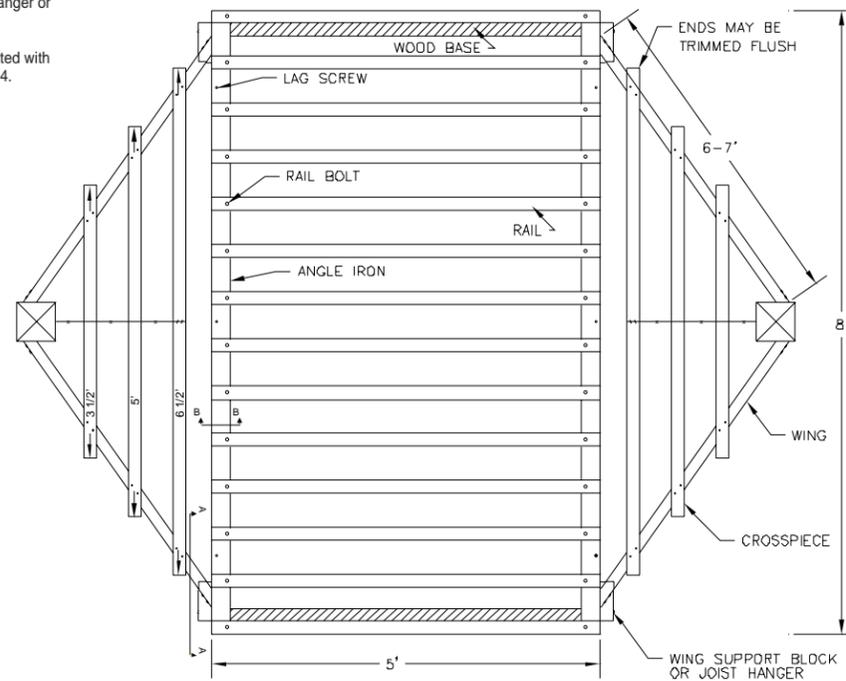
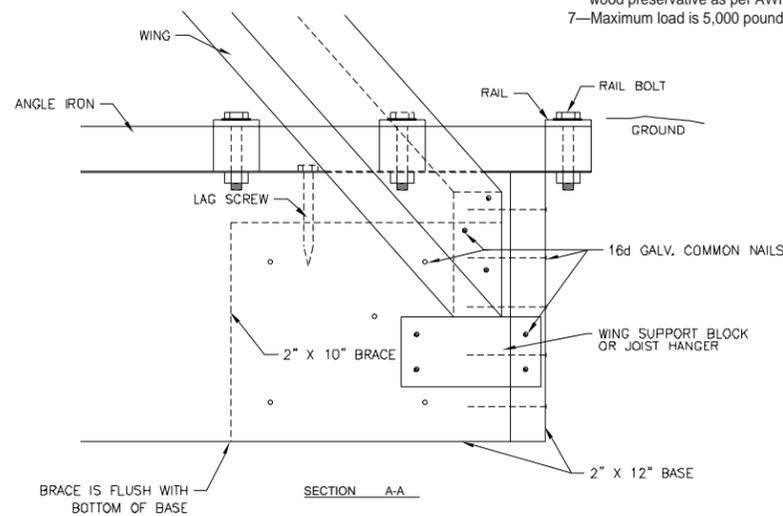
—Technical contact—

Dick Dufourd
USDA Forest Service, Bend/Fort Rock Ranger District
1230 NE 3rd, Suite A-262
Bend, OR 97701
Ph: (541) 383-4004

Appendix A—Deschutes Trail Cattle Guard Plans

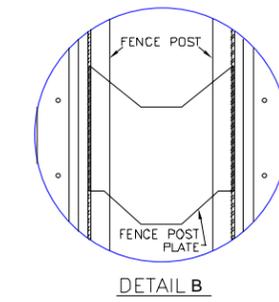
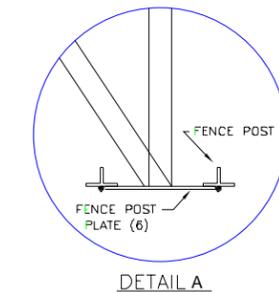
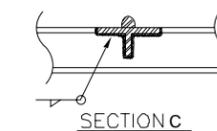
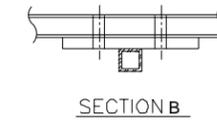
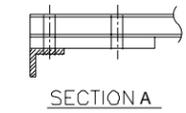
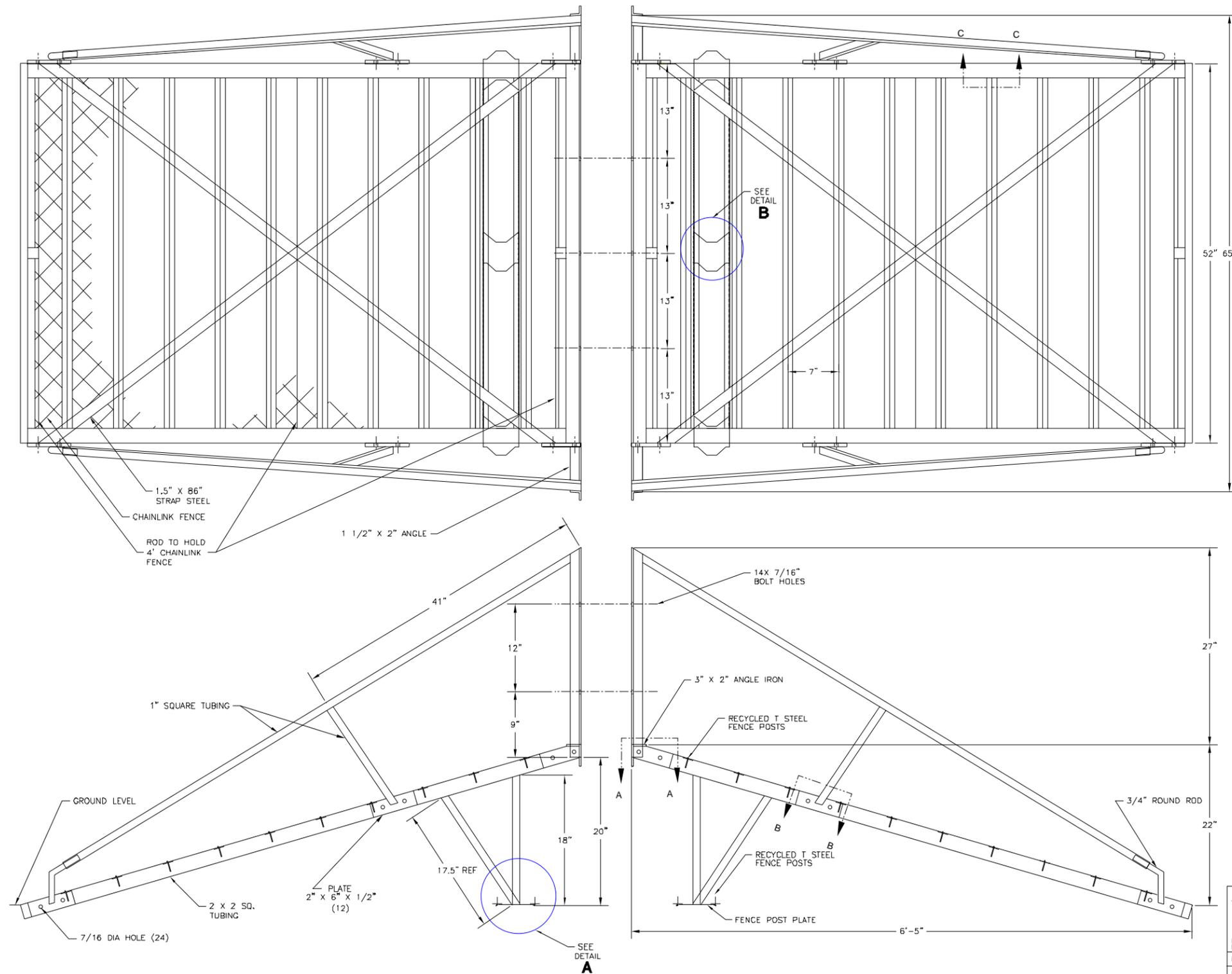


- NOTES**
- 1—All wood shall be pressure treated with creosote or water-borne preservatives with 0.40 retention.
 - 2—Lumber dimensions are nominal.
 - 3—The base shall be installed so all sides have even bearing on the bottom. The top 4 inches below the base shall not contain rocks larger than 3 inches in greatest dimension.
 - 4—Wings may be attached to posts and base with joist hangers which have been field modified to fit. Recommend the Simpson SUR 26 and SUL 26 skewed 45° hanger or similar.
 - 5—See materials list.
 - 6—All field cuts in lumber shall be treated with wood preservative as per AWPA M4.
 - 7—Maximum load is 5,000 pounds.



UNLESS OTHERWISE SPECIFIED	DATE	REVISION	BY
TOLERANCES: FRACTIONS ±1/16" DECIMALS ±0.015" ANGLES ±1/2°			
DRAWN: Deb Mucci			
DESIGNED: Dick Dufourd			
CHECKED:			
APPROVED:			
SCALE: None			
DATE: July 1987			
USDA Forest Service Deschutes NF, Bend/Fort Rock RD Bend, Oregon		TITLE	
Trail Cattle Guard, Deschutes			
Sheet 1 of 1		MTDC-951-3	

Appendix B—Caribou Trail Cattle Guard Plans



See next page for
Materials List
and
Construction Notes

Unless Otherwise Specified TOLERANCES: FRACTIONS +/- DECIMALS +/- ANGLES +/- Dimensions are in inches. Break sharp edges.	DATE _____ REVISION _____ BY _____
DRAWN: Deb Mucci DESIGNED: Mark Booth Carl Stoddard John Newcom	USDA Forest Service Caribou National Forest, Montpelier Ranger District Montpelier, Idaho
SCALE: None DATE: 1995	Trail Cattle Guard, Caribou Sheet 1 of 1 MTDC-951-1

Materials List

24 each: T-type steel fenceposts (preferably used),
6 feet long
9 feet: Angle iron, 3 by 2 inches
10 feet: Angle iron, 1½ by 2 inches
54 feet: Square tubing, 1 by 1 inch
28 feet: Square tubing, 2 by 2 inches
33 feet: Flat bar, ½ by 1½ inches
26 feet: Metal rod, ¾-inch diameter
12 feet: Galvanized chain link fence, 4 feet wide
4 feet: Metal rod, ¾-inch diameter
6 each: Fence post plates
6 feet: Flat bar, ½ by 2 inches
7 each: Lag bolts, ¾ by 1¼ inches, plus lock washers
and nuts
24 each: Lag bolts, ¾ by 3 inches, plus lock washers
and nuts

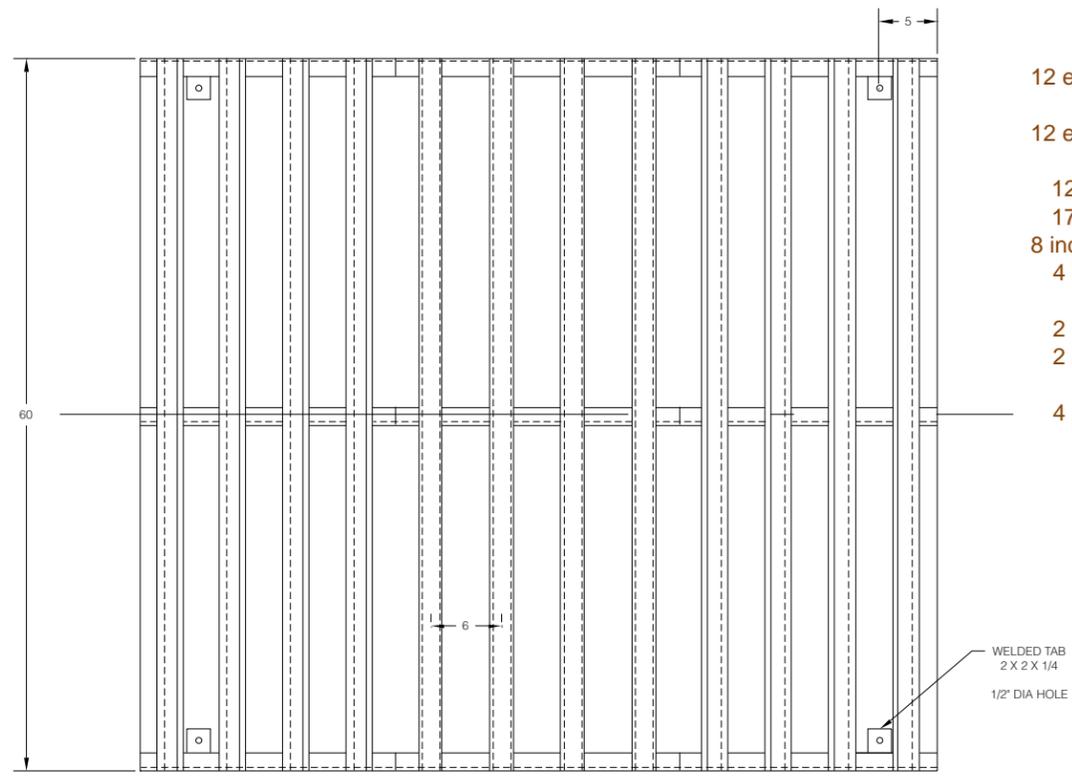
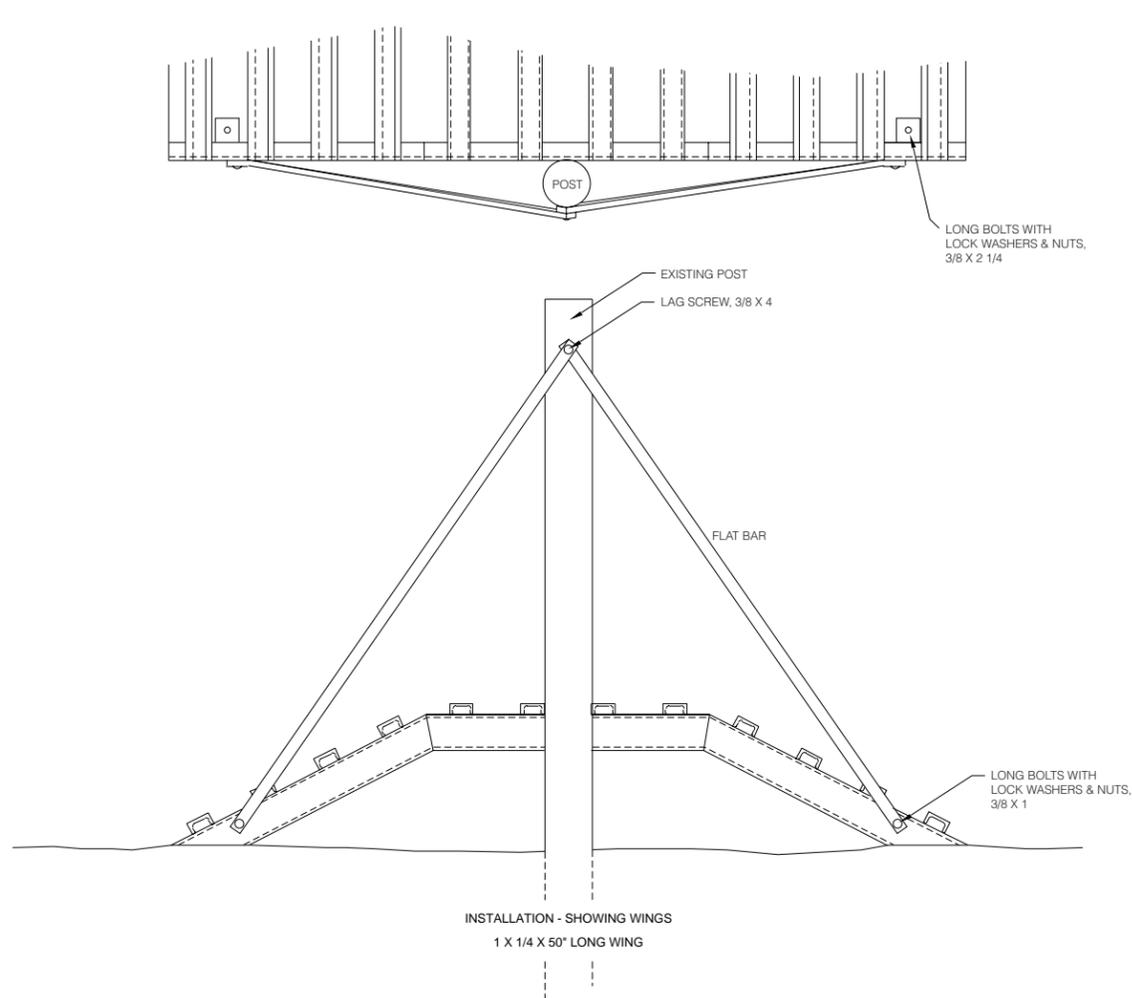
Construction Notes

- The steel fence posts are cut to the proper length, the short pieces are welded on the ends to form additional tread rails, or are used for legs.
- The ¾-inch-diameter rod is cut into short pieces and inserted into the ends of the 1-inch square tubing—the rod is easier to bend and makes for a stronger weld.
- The ¾-inch-diameter rod is slipped through the ends of the chain-link fence material and used to stretch and hold it tight. A short piece of the flat bar is bent and welded at the center of the lowest and highest point of each half of the ramp to add additional strength to the rod. The ends of the rod are finally welded to the inside of the 2-inch square tubing.
- The flat bar is bent at the proper angle on each end and welded to the 2-inch square tubing to provide lateral strength, additional tread strength, and to hold the chain-link fence in place.
- Steel angle iron (2 by 2 inches) could be substituted for the steel fence posts. They would also be welded on the ends to the 1-inch square tubing with the point of the angle facing up.

—Designed by Mark Booth, Carl Stoddard, and John Newcom at:

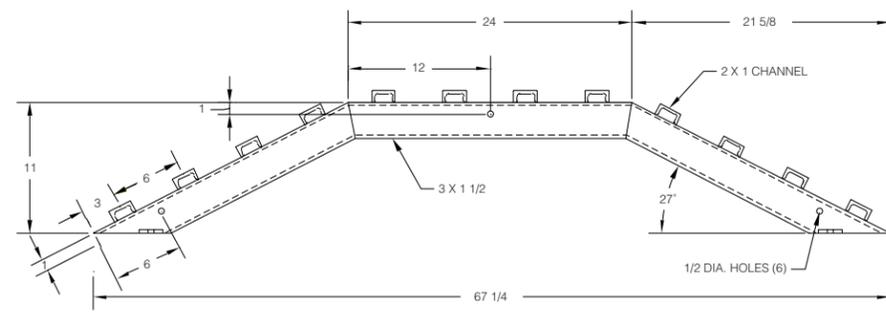
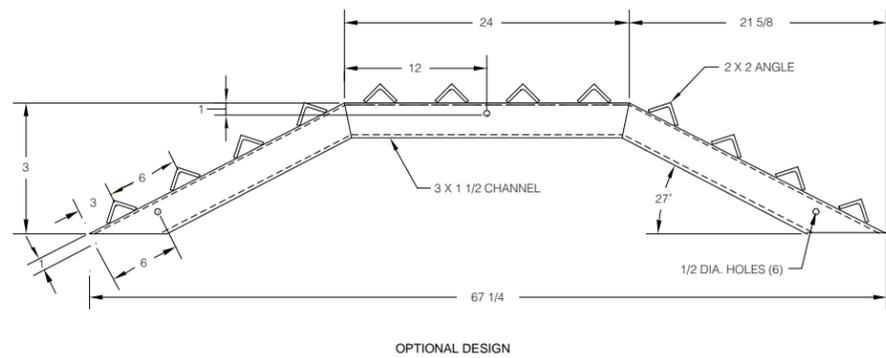
USDA Forest Service, Montpelier Ranger District
322 North 4th Street
Montpelier, ID 83254
Ph: (208) 847-0375
Fax: (208) 847-3426

Appendix C—Deerlodge Trail Cattle Guard Plans



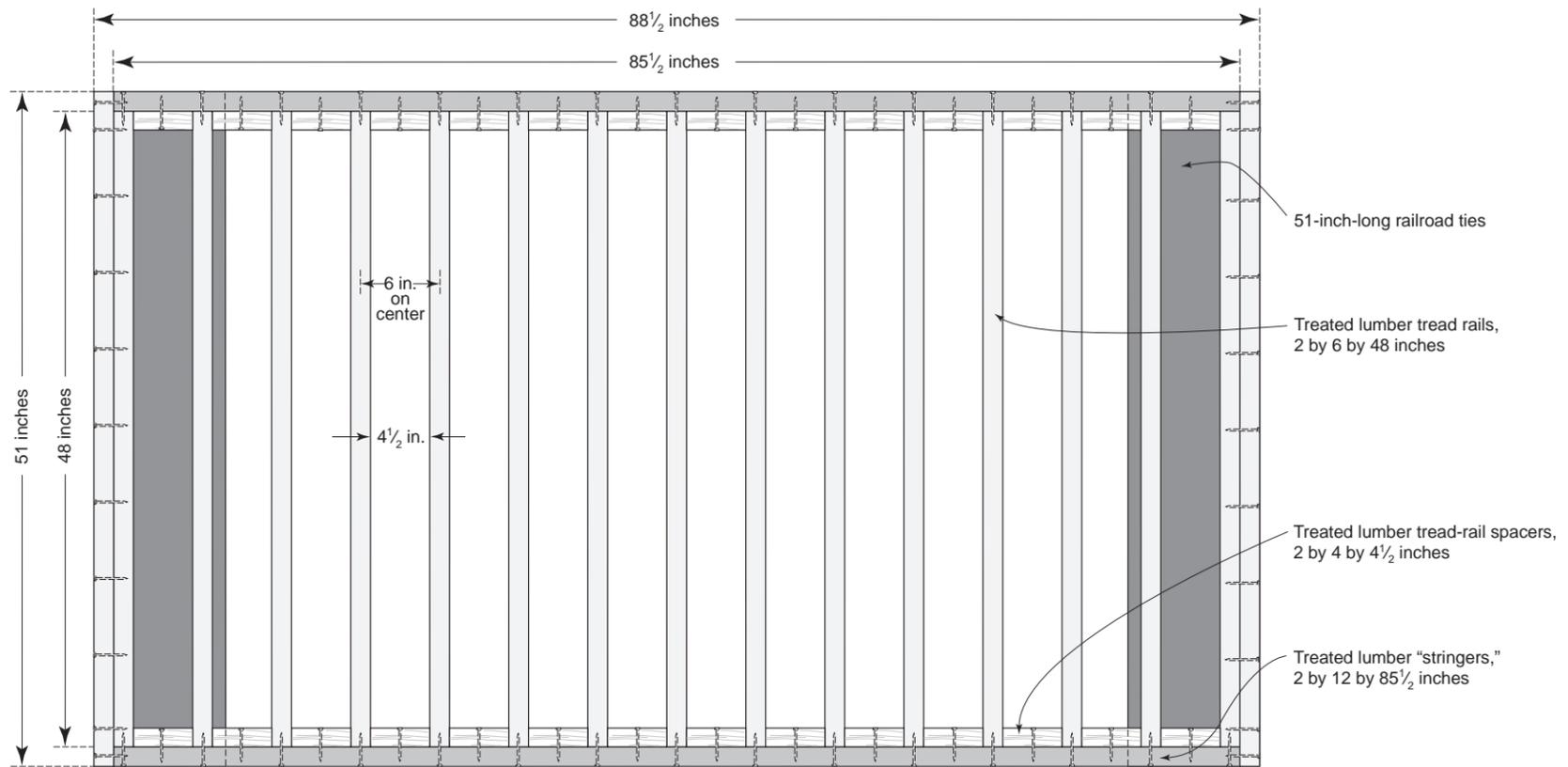
Materials List

- 12 each: Channel for tread rails, 2 by 1 by 60 inches **or**
- 12 each: Angle iron, 2 by 2 by 60 inches
- 12 feet: Channel for "stringers," 3 by 1½ inches
- 17 feet: Flat bar for wings, ¼ by 1 inch
- 8 inches: Flat bar for tabs, ¼ by 2 inches
- 4 each: Long bolts for wings, ⅜ by 1 inch, plus lock washers and nuts
- 2 each: Lag screws for wings, ⅜ by 4 inches
- 2 each: Treated lumber for across ends underneath, 2 by 6 by 60 inches
- 4 each: Long bolts, ⅜ by 2¼ inches, plus lock washers and nuts

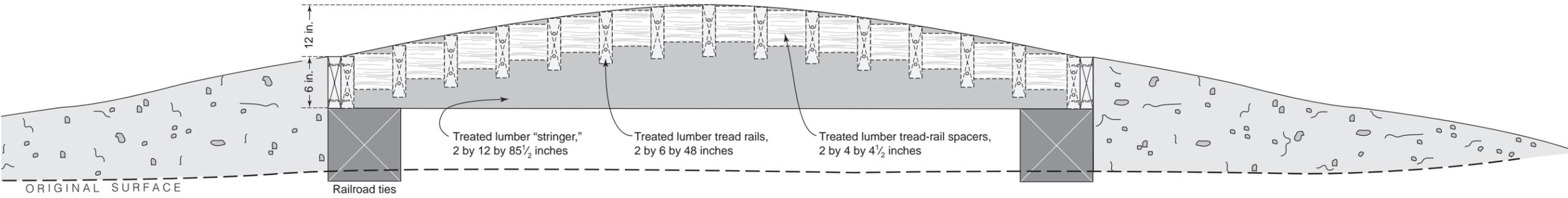


Unless Otherwise Specified	DATE	REVISION	BY
TOLERANCES: FRACTIONS: — DECIMALS: ± ANGLES: ±	USDA Forest Service Deerlodge National Forest, Jefferson Ranger District Whitehall, Montana		
Dimensions are in inches. Break sharp edges.	TITLE Trail Cattle Guard, Deerlodge		
DRAWN: Deb Mucci	Sheet 1 of 1		
DESIGNED: Darrow Hippert Eric Toll	MTDC-951-2		
SCALE: None			
DATE:			

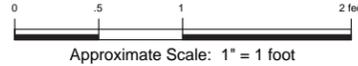
Appendix D—Challis Trail Cattle Guard Plans



PLAN VIEW



ELEVATION VIEW



Materials List

- 15 each: Treated lumber, 2 by 6 by 48 inches
- 2 each: Treated lumber, 2 by 12 by 85 1/2 inches
- 14 each: Treated lumber, 2 by 4 by 4 1/2 inches
- 2 each: Railroad ties, 51 inches long
- 4 each: Treated lumber for wings
- Galvanized annular ring nails
- Wood preservative
- Suitable exterior glue

Construction Notes

- The structure will last much longer if all new cuts made in the lumber are treated with wood preservative.

Unless Otherwise Specified	DATE	REVISION	BY
TOLERANCES: FRACTIONS +/- _____ DECIMALS +/- _____ ANGLES +/- _____ Dimensions are in inches. Break sharp edges.	USDA Forest Service Challis National Forest, Lost River Ranger District Challis, Idaho		
DRAWN: Sara Lustgraaf	Trail Cattle Guard, Challis		
DOCUMENTED BY: Howard Rosenkrance			
APPROX. SCALE: 1 in. = 1 ft.			
DATE: June 1998	Sheet 1 of 1	MTDC-951-4	